PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2001-345318**
(43)Date of publication of application : **14.12.2001**

(51)Int.CI. H01L 21/316
B05C 9/12
B05C 11/08
B05D 5/12
B05D 7/00
B05D 7/24

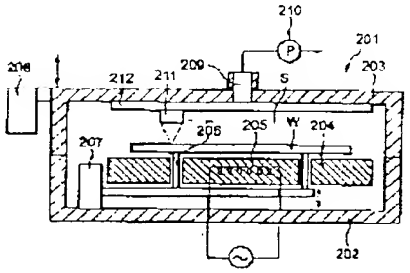
(21)Application number : **2001-055739**
(22)Date of filing : **28.02.2001**

(71)Applicant : **TOKYO ELECTRON LTD**
(72)Inventor : **AKUMOTO MASAMI**
DEGUCHI YOICHI

(30)Priority
Priority number : **2000094879** Priority date : **30.03.2000** Priority country : **JP**

(54) METHOD AND DEVICE FOR COATING

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a new technology which can further reduce the relative permitivity of an interlayer insulating film.
SOLUTION: At a reduced-pressure drying station DCD, a hermetically sealed space S is formed and set to a vacuum state. In this state, the material of an insulating film is foamed by projecting an electron beam upon a wafer W placed on a hot plate 204 from an EB unit 211. Continuously, the material is dried under a reduced pressure by raising the temperature of the hot plate 204 to a prescribed value. Since the material is foamed at the drying station DCD in this way, foams are left in the insulating film and reduce the relative permitivity of the insulating film.



* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] (a) The method of application characterized by providing the process which applies insulator layer material on a substrate, the process at which the insulator layer material applied on the aforementioned substrate is made to foam under (b) reduced pressure, and the process which dries the aforementioned insulator layer material in the state where the (c) aforementioned insulator layer material was made to foam.
[Claim 2] The method of application characterized by making the lower layer section foam intensively in the method of application according to claim 1 among the insulator layer material applied on the aforementioned substrate at the aforementioned process (b).
[Claim 3] The method of application characterized by irradiating an EB intensively at the aforementioned lower layer section, and making this lower layer section foam at the aforementioned process (b) in the method of application according to claim 2.
[Claim 4] The method of application characterized by drying the aforementioned insulator layer material before arriving at a management among the insulator layer material by which the gas into which it foamed in the aforementioned lower layer section by the aforementioned process (c) was applied on the aforementioned substrate in the method of application according to claim 2.
[Claim 5] The method of application characterized by drying the aforementioned insulator layer material under reduced pressure at the aforementioned process (c) in the method of application according to claim 1.
[Claim 6] The method of application characterized by making an ultrasonic wave supply and foam into the aforementioned insulator layer material at the aforementioned process (b) in the method of application according to claim 1.
[Claim 7] The method of application characterized by making vibration give and foam into the aforementioned insulator layer material at the aforementioned process (b) in the method of application according to claim 1.
[Claim 8] The method of application characterized by making infrared radiation irradiate and foam into the aforementioned insulator layer material at the aforementioned process (b) in the method of application according to claim 1.
[Claim 9] The method of application characterized by providing further the process which heat-treats a substrate at an elevated temperature after the (d) aforementioned process (c) in the method of application according to claim 1.
[Claim 10] The method of application characterized by providing further the process which requires fixed time between the aforementioned process (c) and the aforementioned process (d), and conveys a substrate in a method according to claim 9.
[Claim 11] The method of application characterized by drying the aforementioned insulator layer material under hypoxia atmosphere at the aforementioned process (c) in the method of application according to claim 1.
[Claim 12] (a) The method of application characterized by providing the process which dries the process which applies insulator layer material on a substrate, and the substrate to which the aforementioned insulator layer material was applied while supplying the ultrasonic wave to the

insulator layer material applied on the (b) aforementioned substrate.
[Claim 13] The method of application characterized by dissolving the gas in the aforementioned insulator layer material in the method of application according to claim 12.
[Claim 14] It is the method of application characterized by the aforementioned gas having a dielectric constant lower than the aforementioned insulator layer material in the method of application according to claim 13.
[Claim 15] The method of application characterized by calcinating the front face of the aforementioned insulator layer material after the aforementioned process (b) in the method of application according to claim 12.
[Claim 16] (a) The method of application characterized by to provide the process dried to the grade at which the fluidity of the aforementioned insulator layer material can maintain the process which applies insulator layer material on a substrate, and the substrate to which the aforementioned insulator layer material was applied while supplying the ultrasonic wave to the insulator layer material applied on the (b) aforementioned substrate to some extent, and the process which turns a substrate over and is dried after the (c) aforementioned process (b).
[Claim 17] The coater characterized by providing the following. The maintenance and the rolling mechanism rotated holding a substrate. The 1st processing room possessing the feeder style which supplies insulator layer material on the substrate held by the aforementioned mechanism and rolling mechanism. The 2nd processing room for drying the insulator layer material on the foaming mechanism in which the insulator layer material supplied on the substrate is made to foam under reduced pressure, and a substrate. The conveyance mechanism in which a substrate is conveyed from the processing room of the above 1st to the processing room of the above 2nd.
[Claim 18] The coater characterized by preparing the aforementioned foaming mechanism in the processing interior of a room of the above 2nd in a coater according to claim 17.
[Claim 19] The coater characterized by having the ultrasonic feeder style at which the aforementioned foaming mechanism supplies an ultrasonic wave to the aforementioned insulator layer material in a coater according to claim 17.
[Claim 20] The coater characterized by having the oscillating feeder style at which the aforementioned foaming mechanism supplies vibration to the aforementioned insulator layer material in a coater according to claim 17.
[Claim 21] The coater to which the aforementioned foaming mechanism is characterized by having the infrared lamp which irradiates infrared radiation at the aforementioned insulator layer material in a coater according to claim 17.
[Claim 22] The coater to which the aforementioned foaming mechanism is characterized by having the EB irradiation mechanism which irradiates an EB at the aforementioned insulator layer material in a coater according to claim 17.
[Claim 23] It is the coater which the aforementioned insulator layer material applied on the substrate has a management and the lower layer section in a coater according to claim 22, and is characterized by the aforementioned EREKURON beam irradiation mechanism irradiating the aforementioned lower layer section intensively.
[Claim 24] In a coater according to claim 17, it has further the 3rd processing room for heat-treating a substrate at an elevated temperature. the aforementioned conveyance mechanism It is the coater characterized by providing further the control section which controls the aforementioned conveyance mechanism so that time to convey a substrate in the processing room of the above 3rd from the processing room of the above 2nd, and for the aforementioned coater convey a substrate in the processing room of the above 3rd from the processing room of the above 2nd becomes fixed.
[Claim 25] The coater characterized by providing the following. The maintenance and the rolling mechanism rotated holding a substrate. The 1st processing room possessing a supply means to supply insulator layer material on the substrate held by the aforementioned mechanism and rolling mechanism. The 2nd processing room which dries a substrate under reduced pressure while supplying an ultrasonic wave to the insulator layer material on a substrate. The conveyance mechanism in which a substrate is conveyed from the processing room of the above 1st to the

processing room of the above 2nd.
[Claim 26] It is the coater characterized by providing further the mechanism in which the processing room of the above 2nd reverses the front reverse side of a substrate in a coater according to claim 25.
[Claim 27] It is the coater characterized by providing further the mechanism in which the front face of insulator layer material where the processing room of the above 2nd was applied on the substrate in the coater according to claim 25 is calcinated.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the method of application and the coater which apply an insulating material on substrates, such as for example, a semiconductor wafer.
[0002]
[Description of the Prior Art] It is in the inclination for the demand of high density assembly to become strong in the field of LSI, and for a wiring rule to become still severer. If wiring density becomes large, the capacity between wiring will become large and the fall of signal transduction speed etc. will actualize. Delay of signal transduction speed is proportional to the square root of the product of wiring resistance and the electrostatic capacity of wiring, and has become the dominant factor from which this delay prevents the high-speed responsibility of the whole device.
[0003] Although the design of a circuit pattern can be devised or it is possible between wiring of a layer different, for example to thicken thickness of a layer insulation film in order to avoid such delay, between the wiring in this layer, it is common to use material with small specific inductive capacity for a layer insulation film.
[0004]
[Problem(s) to be Solved by the Invention] However, when there is a limitation only by avoiding delay of signal transduction speed and progress of future high-density-assembly-izing is taken into consideration by selection of such a material, a proposal of the new evasion technique is desired.
[0005] Since this invention was made based on such a situation, it aims at offering the new technology which can make smaller specific inductive capacity of a layer insulation film.
[0006]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the 1st viewpoint of this invention possesses the process which applies insulator layer material on the (a) substrate, the process at which the insulator layer material applied on the aforementioned substrate is made to foam under (b) reduced pressure, and the process which it is [process] in the state in which the (c) aforementioned insulator layer material was made to foam, and dries the aforementioned insulator layer material in the method of application.
[0007] The 2nd viewpoint of this invention possesses the process which dries the process which applies insulator layer material on the (a) substrate, and the substrate to which the aforementioned insulator layer material was applied while supplying the ultrasonic wave to the insulator layer material applied on the (b) aforementioned substrate in the method of application.
[0008] The 3rd viewpoint of this invention possesses the process which dries to the grade at which the fluidity of the aforementioned insulator layer material can maintain the process which applies insulator layer material on the (a) substrate in the method of application, and the substrate to which the aforementioned insulator layer material was applied while supplying the ultrasonic wave to the insulator layer material applied on the (b) aforementioned substrate to some extent, and the process which turn a substrate over and dry after the (c) aforementioned process (b).
[0009] The 4th viewpoint of this invention the 1st processing room possessing the maintenance and the rolling mechanism rotated in a coater, holding a substrate, and the feeder style which supplies insulator layer material on the substrate held by the aforementioned mechanism and rolling mechanism, and under reduced pressure The conveyance mechanism in which a substrate is conveyed to the processing room of the above 2nd from the foaming mechanism in which the insulator layer material supplied on the substrate is made to foam, the 2nd processing room for drying the insulator layer material on a substrate, and the processing room of the above 1st is provided.
[0010] The maintenance and the rolling mechanism rotated the 5th viewpoint of this invention

holding a substrate in a coater, The 1st processing room possessing a supply means to supply insulator layer material on the substrate held by the aforementioned mechanism and rolling mechanism, The conveyance mechanism in which a substrate is conveyed to the processing room of the above 2nd from the 2nd processing room which dries a substrate under reduced pressure, and the processing room of the above 1st is provided supplying an ultrasonic wave to the insulator layer material on a substrate.
[0011] In these this inventions, since a bubble remains into an insulator layer, specific inductive capacity can be reduced.
[0012]
[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing.
[0013] Drawing 1 - drawing 3 are drawings showing the whole SOD processing-system composition concerning 1 operation gestalt of this invention, and drawing 1 is [front view and drawing 3 of a plan and drawing 2] rear view.
[0014] This SOD processing system 1 is a semiconductor wafer (it is hereafter called a wafer.) as a substrate. The cassette block 10 for carrying in and taking out Wafer W to the wafer cassette CR, The processing block 11 which comes to carry out multi-stage arrangement of the various processing stations of single wafer processing which performs one predetermined processing at a time to Wafer W in a SOD application process in a predetermined position, It has the composition which connected to one the cabinet 12 in which the bottle of the aqueous ammonia needed at an aging process, the bubbler, the drain bottle, etc. were installed.
[0015] In the cassette block 10, as shown in drawing 1 , the wafer cassette CR to four pieces turns each wafer entrance to the position of salient 20a on the cassette installation base 20 at the processing block 11 side, and are laid in the direction single tier of X in it, for example. [two or more] The wafer conveyance object 21 which can move in the wafer array direction (Z perpendicular direction) of the wafer contained in the cassette array direction (the direction of X) and the wafer cassette CR accesses each wafer cassette CR alternatively. Furthermore, this wafer conveyance object 21 is constituted possible [rotation] in the direction of theta, and can also access now delivery / cooling plate (TCP) which belongs to the multi-stage station section of 3rd group G3 by the side of the processing block 11 so that it may mention later.
[0016] In the processing block 11, as shown in drawing 1 , the perpendicular conveyance type main wafer conveyance mechanism 22 as a transport device is formed in a core, all processing stations cover the surroundings of it at 1 set or two or more groups, and it is arranged multi-stage. In this example, 4 sets is G1, G2, G3, and the multi-stage arrangement composition of G4, and the multi-stage station of the 1st and 2nd groups G1 and G2 is juxtaposed at a system transverse-plane (it sets to drawing 1 and is this side) side, the multi-stage station of 3rd group G3 adjoins the cassette block 10, and is arranged, and the multi-stage station of the 4th group G4 adjoins a cabinet 12, and is arranged.
[0017] As shown in drawing 2 , in the 1st group G1, put Wafer W on a spin chuck within Cup CP, and insulator layer material is supplied. The SOD application processing station which applies a uniform insulator layer material on a wafer by rotating a wafer (staphylococcal clumping test), Put Wafer W on a spin chuck within Cup CP. for example, medical fluids for an exchange, such as HMDS and a heptane, are supplied. The solvent exchange processing station (DSE) which performs processing which transposes the solvent in the insulator layer applied on the wafer to other solvents in front of a dryness process has put on two steps in order of the lower shell.
[0018] In the 2nd group G2, the wafer W with which insulator layer material was applied at the SOD application processing station (staphylococcal clumping test) was made to foam under reduced pressure, and the reduced-pressure-drying station (DCD) to dry and the SOD application processing station (staphylococcal clumping test) have put on two steps in order of the lower shell.
[0019] As shown in drawing 3 , in 3rd group G3, two hypoxia heating-at-high-temperature processing stations (OHP), low-temperature heat-treatment stations (LHP), two cooling processing stations (CPL), delivery / cooling plates (TCP), and cooling processing stations (CPL) are arranged sequentially from the top multi-stage. here -- a hypoxia heating-at-high-

temperature processing station (OHP) -- **** -- it has the hot platen by which Wafer W is laid in the processing interior of a room [-izing / the interior of a room], and it exhausts from the center of the processing room upper part, breathing out N2 from the hole of the periphery of a hot platen to homogeneity, and heating-at-high-temperature processing of the wafer W is carried out in hypoxia-ized atmosphere A low-temperature heat-treatment station (LHP) has the hot platen in which Wafer W is laid, and carries out low-temperature heat-treatment of the wafer W. A cooling processing station (CPL) has the cooling plate with which Wafer W is laid, and carries out cooling processing of the wafer W. Delivery / cooling plate (TCP) is made into the cooling plate which cools Wafer W in the lower berth, and the two-step structure of delivering to an upper case and having a base, and delivers Wafer W between the cassette block 10 and the processing block 11.

[0020] In the 4th group G4, a low-temperature heat-treatment station (LHP), two hypoxia cures and cooling processing stations (DCC), and aging processing stations (DAC) are arranged sequentially from the top multi-stage. here -- a hypoxia cure and a cooling processing station (DCC) -- **** -- it has so that the processing interior of a room [-izing / the interior of a room] may be adjoined in a hot platen and a cooling plate, and cooling processing of the wafer W heat-treated while carrying out heating-at-high-temperature processing in the hypoxia atmosphere replaced N2 is carried out an aging processing station (DAC) -- **** -- the processing gas (NH3+H2O) which mixed for example, ammonia gas and the steam is introduced into the processing interior of a room [-izing / the interior of a room], aging processing of the wafer W is carried out, and the wet gelling of the insulator layer material on Wafer W is carried out

[0021] The wafer transport device 30 which can go up and down freely in the vertical direction (Z direction) inside the tubed base material 27 which drawing 4 is the perspective diagram having shown the appearance of the main wafer conveyance mechanism 22, and consists of walls 25 and 26 of the couple which this main wafer conveyance mechanism 22 is mutually connected by the upper limit and the soffit, and counters is equipped. It connects with the axis of rotation of a motor 31, and the tubed base material 27 rotates to the wafer transport device 30 and one focusing on the aforementioned axis of rotation with the rotation driving force of this motor 31. Therefore, the wafer transport device 30 can be freely rotated in the direction of theta. On the conveyance pedestal 40 of this wafer transport device 30, it has three pincettes, for example. These pincettes 41, 42, and 43 all have the gestalt and size which can pass both the walls 25 of the tubed base material 27, and the side opening 44 between 26 freely, and they are constituted so that order movement may be attained along the direction of X. And the main wafer conveyance mechanism 22 accesses pincettes 41, 42, and 43 at the processing station arranged at the circumference, and delivers Wafer W between these processing stations.

[0022] Next, a SOD application processing station (staphylococcal clumping test) is explained. Drawing 5 and drawing 6 are the outline cross sections and outline plans showing the whole SOD application processing station (staphylococcal clumping test) composition.

[0023] The annular cup CP is arranged in the center section of this SOD application processing station (staphylococcal clumping test), and the spin chuck 52 is arranged inside Cup CP. Where fixed maintenance of the wafer W is carried out by vacuum adsorption, the rotation drive of the spin chuck 52 is carried out by the drive motor 54. The drive motor 54 is combined with the rise-and-fall driving means 60 and the rise-and-fall guide means 62 which consist of a pneumatic cylinder through the flange material 58 of the shape of a cap which is arranged possible [rise-and-fall movement to opening 50a prepared in the unit bottom plate 50], for example, consists of aluminum. The tubed cooling jacket 64 which consists of an SUS is attached in the side of a drive motor 54, and the flange material 58 is attached so that the Johan section of this cooling jacket 64 may be covered.

[0024] At the time of the application of insulator layer material, soffit 58a of the flange material 58 is stuck to the unit bottom plate 50 near the periphery of opening 50a, and the interior of a unit is sealed by this. When delivery of Wafer W is performed between a spin chuck 52 and the pincette 41 (42 43) of the main wafer conveyance mechanism 22, the soffit of the flange material 58 floats from the unit bottom plate 50 because the rise-and-fall driving means 60 raise a drive

motor 54 or a spin chuck 52 upwards.
[0025] The nozzle 86 for supplying insulator layer material to the front face of Wafer W is connected to the insulator layer material feed zone 89 through the supply pipe 88. This nozzle 86 is attached in the point of the nozzle scan arm 92 removable through the nozzle supporter 100. This nozzle scan arm 92 is attached on the unit bottom plate 50 at the upper-limit section of the perpendicular supporter material 96 in which horizontal displacement is possible on the guide rail 94 laid by ** (the direction of Y) on the other hand, and moves in the direction of Y with the direction drive of Y which is not illustrated at the perpendicular supporter material 96 and one.
[0026] Furthermore, the nozzle scan arm 92 is movable also in the direction of Y, and the right-angled direction of X in order to attach a nozzle 86 alternatively in the nozzle standby section 90, and it moves also in the direction of X with the direction drive of X which is not illustrated.
[0027] The insulator layer material at the nose of cam of a nozzle solidifies or deteriorates by the delivery of a nozzle 86 being inserted in mouth 90a of a solvent atmosphere room in the nozzle standby section 90, and being exposed to the atmosphere of a solvent in inside further again. Moreover, two or more nozzles 86 are formed, for example, those nozzles are properly used according to the kind of insulator layer material. Moreover, the nozzle 86 is attached so that a delivery may be located on the straight line which meets in the Y move direction of the nozzle scan arm 92.
[0028] Next, a reduced-pressure-drying station (DCD) is explained. Drawing 7 is the cross section showing the composition of a reduced-pressure-drying station (DCD).
[0029] The chamber 201 as a processing room consists of combination of a pedestal 202 and a lid 203.
[0030] The hot platen 204 is arranged on the pedestal 202. A heater 205 is arranged in a hot platen 204, and, thereby, a hot platen 204 is set as desired temperature.
[0031] Plurality 206, for example, three rise-and-fall pins, can appear frequently from hot-platen 204 front face by the elevator style 207 arranged at the rear-face side of a hot platen 204. And after the rise-and-fall pin 206 has projected from hot-platen 204 front face, delivery of Wafer W is performed between the main wafer conveyance mechanisms 22.
[0032] The lid 203 is arranged by the elevator style 208 possible [rise and fall]. And when a lid 203 descends, a closed space S is formed between a pedestal 202 and a lid 203.
[0033] The exhaust port 209 is formed in the lid 203, and the inside of a closed space S is exhausted by the vacuum pump 210 through this exhaust port 209, and it changes into the state near a vacuum about 0.05Torr-1Torr.
[0034] In the rear face of a lid 203, the EB unit 211 which irradiates an EB to the wafer W arranged on a hot platen 204, and the scanner 212 which scans this EB unit since it continues all over wafer W and the EB irradiated from this EB unit 211 is irradiated are arranged. Even if a scanner 212 may move the EB unit 211 to ** on the other hand corresponding to the EB unit 211 and it moves it in the XY direction, it is not cared about. Moreover, the EB unit 211 irradiates an EB intensively and, thereby, makes the lower layer section 214 foam in the lower layer section 214 intensively among the lower layer sections 214 of the insulator layer material 213 and the managements 215 which were applied to Wafer W, as shown in drawing 8 .
[0035] Next, operation in the SOD system 1 constituted in this way is explained. Drawing 9 shows the processing flow in this SOD system 1.
[0036] In the cassette block 10, the wafer W before processing is conveyed to the delivery base in delivery / cooling plate (TCP) which belongs to 3rd group G3 by the side of the processing block 11 through the wafer conveyance object 21 from the wafer cassette CR first.
[0037] The wafer W conveyed on the delivery base in delivery / cooling plate (TCP) is conveyed through the main wafer conveyance mechanism 22 at a cooling processing station (CPL). And at a cooling processing station (CPL), Wafer W is cooled to the temperature which suits the processing in a SOD application processing station (staphylococcal clumping test) (Step 901).
[0038] The wafer W by which cooling processing was carried out is conveyed through the main wafer conveyance mechanism 22 at a SOD application processing station (staphylococcal clumping test) at a cooling processing station (CPL). And as for Wafer W, SOD application processing is performed at a SOD application processing station (staphylococcal clumping test)

(Step 902).
[0039] The wafer W with which SOD application processing was performed at the SOD application processing station (staphylococcal clumping test) is conveyed through the main wafer conveyance mechanism 22 at a reduced-pressure-drying station (DCD), and reduced-pressure-drying processing is performed (Step 903).
[0040] At a reduced-pressure-drying station (DCD), the wafer W with which insulator layer material was first applied by the SOD application processing station (staphylococcal clumping test) is laid in a hot platen 204 through the main wafer conveyance mechanism 22. And while the inside of a closed space S is formed, this closed space is made into a vacua. In this state, an EB is irradiated to the wafer W laid in the hot platen 204 from the EB unit 211, and insulator layer material foams (step 903A). Continuously, the temperature up of the hot platen 204 is carried out to predetermined temperature, and dryness processing under reduced pressure is performed (step 903B). In addition, you may be made to perform Steps 903A and 903B almost simultaneous.

[0041] The wafer W with which dryness processing was performed is conveyed through the main wafer conveyance mechanism 22 at an aging processing station (DAC) at a reduced-pressure-drying station (DCD). At this time, to be shown in drawing 10 , the control section 216 is controlling conveyance of the main wafer conveyance mechanism 22 so that the time T taken to convey Wafer W from a reduced-pressure-drying station (DCD) to an aging processing station (DAC) becomes fixed. Thereby, dispersion in a dielectric constant or thickness can be suppressed.
[0042] And at an aging processing station (DAC), Wafer W introduces NH3+H2O into the processing interior of a room, carries out aging processing of the wafer W, and gels the insulator layer material film on Wafer W (Step 904).
[0043] The wafer W by which aging processing was carried out is conveyed through the main wafer conveyance mechanism 22 at a solvent exchange processing station (DSE) at an aging processing station (DAC). And at a solvent exchange processing station (DSE), processing with which, as for Wafer W, the medical fluid for an exchange replaces the solvent in the insulator layer which was supplied and was applied on the wafer to other solvents is performed (Step 905).

[0044] The wafer W with which substitution processing was performed is conveyed through the main wafer conveyance mechanism 22 at a low-temperature heat-treatment station (LHP) at a solvent exchange processing station (DSE). And at a low-temperature heat-treatment station (LHP), low-temperature heat-treatment of the wafer W is carried out (Step 906). Of course, it does not matter even if it also performs this low-temperature heat-treatment under hypoxia atmosphere or reduced pressure.
[0045] The wafer W by which low-temperature heat-treatment was carried out is conveyed through the main wafer conveyance mechanism 22 at a hypoxia heating-at-high-temperature processing station (OHP) at a low-temperature heat-treatment station (LHP). And at a hypoxia heating-at-high-temperature processing station (OHP), as for Wafer W, heating-at-high-temperature processing in hypoxia-ized atmosphere is performed (Step 907).
[0046] The wafer W with which heating-at-high-temperature processing was performed is conveyed through the main wafer conveyance mechanism 22 at a hypoxia cure and a cooling processing station (DCC) at a hypoxia heating-at-high-temperature processing station (OHP). And at a hypoxia cure and a cooling processing station (DCC), in hypoxia atmosphere, heating-at-high-temperature processing is carried out, and cooling processing of the wafer W is carried out (Step 908).
[0047] The wafer W processed at the hypoxia cure and the cooling processing station (DCC) is conveyed through the main wafer conveyance mechanism 22 to the cooling plate in delivery / cooling plate (TCP). And cooling processing of the wafer W is carried out in the cooling plate in delivery / cooling plate (TCP) (Step 909).
[0048] The wafer W by which cooling processing was carried out with the cooling plate in delivery / cooling plate (TCP) is conveyed through the wafer conveyance object 21 to the wafer cassette CR in the cassette block 10.

[0049] In this operation gestalt, since foaming processing is performed at the reduced-pressure-drying station (DCD), as shown in drawing 15 , a bubble 111 can remain in 110 in an insulator layer, and specific inductive capacity can be reduced by existence of this bubble 111. Moreover, since this foaming and dryness are performed under reduced pressure, the bubble 111 generated in an insulator layer 110 is not crushed. Therefore, capacity during the wiring 112 formed in this layer can be made small. Moreover, since foaming processing is performed so that the lower layer section may foam intensively among 110 in an insulator layer especially, there is no bubble in a front face, for example, application of the DAMASHIN method becomes easy.
[0050] With the above-mentioned operation gestalt, although foaming processing in a reduced-pressure-drying station (DCD) was performed using the EB, as shown in drawing 11 , even if it attaches a sonicator 301 in a hot platen 204 and supplies an ultrasonic wave to the insulator layer material on Wafer W through a hot platen 204, foaming processing can be performed. Moreover, foaming processing can be performed, even if it attaches a vibration generator system 302 in a hot platen 204 and gives vibration to the insulator layer material on Wafer W through a hot platen 204, as shown in drawing 12 . Furthermore, as shown in drawing 13 , foaming processing can be performed also by attaching the infrared lamp 303 which irradiates infrared radiation to Wafer W on a hot platen 204, and irradiating infrared radiation at the insulator layer material on the wafer W on a hot platen 204. In this case, an infrared lamp 303 can be used together as a means to calcinate the front face of insulator layer material at the time of dryness, and can stiffen a front face by this, for example, it becomes easy to apply [of the DAMASHIN method] it.
[0051] Moreover, this invention is not limited to the operation gestalt mentioned above, but various deformation is possible for it.
[0052] For example, the dielectric constant makes the low gas beforehand dissolved in insulator layer material rather than insulator layer material, and you may make it actualize a gas as a bubble under the reduced pressure at the time of the above-mentioned dryness. Thereby, in addition to the bubble of the above-mentioned vacuum, the specific inductive capacity of an insulator layer can be reduced also with this bubble.
[0053] Furthermore, in case dryness processing of the wafer W is carried out at a reduced-pressure-drying station (DCD), it dries to the grade which can maintain the fluidity of insulator layer material to some extent (step 903C), Wafer W is turned over after that, and you may make it dry, as shown in drawing 14 (step 903D). When Wafer W is turned over, a bubble will float up and a bubble will focus into the insulator layer during wiring. By this, the specific inductive capacity of an insulator layer can be reduced, moreover, there is no bubble, and a front face can be stiffened, for example, application of the DAMASHIN method becomes easy.
[0054] this invention is not limited to the gestalt of operation mentioned above, but can deform variously. For example, the substrates to process may be other things, such as not only a semiconductor wafer but a LCD substrate. Moreover, a membranous kind is not restricted to a layer insulation film.
[0055]
[Effect of the Invention] Since a bubble can remain into an insulator layer, and specific inductive capacity can be reduced and dryness is performed under reduced pressure as explained above, the bubble generated in the aforementioned insulator layer is not crushed. Therefore, specific inductive capacity of a layer insulation film can be made smaller.

[Translation done.]

TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the method of application and the coater which apply an insulating material on substrates, such as for example, a semiconductor wafer.

[Translation done.]

PRIOR ART

[Description of the Prior Art] It is in the inclination for the demand of high density assembly to become strong in the field of LSI, and for a wiring rule to become still severer. If wiring density becomes large, the capacity between wiring will become large and the fall of signal transduction speed etc. will actualize. Delay of signal transduction speed is proportional to the square root of the product of wiring resistance and the electrostatic capacity of wiring, and has become the dominant factor from which this delay prevents the high-speed responsibility of the whole device.

[0003] Although the design of a circuit pattern can be devised or it is possible between wiring of a layer different, for example to thicken thickness of a layer insulation film in order to avoid such delay, between the wiring in this layer, it is common to use material with small specific inductive capacity for a layer insulation film.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since a bubble can remain into an insulator layer, and specific inductive capacity can be reduced and dryness is performed under reduced pressure as explained above, the bubble generated in the aforementioned insulator layer is not crushed. Therefore, specific inductive capacity of a layer insulation film can be made smaller.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when there is a limitation only by avoiding delay of signal transduction speed and progress of future high-density-assembly-izing is taken into consideration by selection of such a material, a proposal of the new evasion technique is desired.

[0005] Since this invention was made based on such a situation, it aims at offering the new technology which can make smaller specific inductive capacity of a layer insulation film.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the 1st viewpoint of this invention possesses the process which applies insulator layer material on the (a) substrate, the process at which the insulator layer material applied on the aforementioned substrate is made to foam under (b) reduced pressure, and the process which it is [process] in the state in which the (c) aforementioned insulator layer material was made to foam, and dries the aforementioned insulator layer material in the method of application.
[0007] The 2nd viewpoint of this invention possesses the process which dries the process which applies insulator layer material on the (a) substrate, and the substrate to which the aforementioned insulator layer material was applied while supplying the ultrasonic wave to the insulator layer material applied on the (b) aforementioned substrate in the method of application.
[0008] The 3rd viewpoint of this invention possesses the process which dries to the grade at which the fluidity of the aforementioned insulator layer material can maintain the process which applies insulator layer material on the (a) substrate in the method of application, and the substrate to which the aforementioned insulator layer material was applied while supplying the ultrasonic wave to the insulator layer material applied on the (b) aforementioned substrate to some extent, and the process which turn a substrate over and dry after the (c) aforementioned process (b).
[0009] The 4th viewpoint of this invention the 1st processing room possessing the maintenance and the rolling mechanism rotated in a coater, holding a substrate, and the feeder style which supplies insulator layer material on the substrate held by the aforementioned mechanism and rolling mechanism, and under reduced pressure The conveyance mechanism in which a substrate is conveyed to the processing room of the above 2nd from the foaming mechanism in which the insulator layer material supplied on the substrate is made to foam, the 2nd processing room for drying the insulator layer material on a substrate, and the processing room of the above 1st is provided.
[0010] The maintenance and the rolling mechanism rotated the 5th viewpoint of this invention holding a substrate in a coater, The 1st processing room possessing a supply means to supply insulator layer material on the substrate held by the aforementioned mechanism and rolling mechanism, The conveyance mechanism in which a substrate is conveyed to the processing room of the above 2nd from the 2nd processing room which dries a substrate under reduced pressure, and the processing room of the above 1st is provided supplying an ultrasonic wave to the insulator layer material on a substrate.
[0011] In these this inventions, since a bubble remains into an insulator layer, specific inductive capacity can be reduced.
[0012]
[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing.
[0013] Drawing 1 - drawing 3 are drawings showing the whole SOD processing-system composition concerning 1 operation gestalt of this invention, and drawing 1 is [front view and drawing 3 of a plan and drawing 2] rear view.
[0014] This SOD processing system 1 is a semiconductor wafer (it is hereafter called a wafer.) as a substrate. The cassette block 10 for carrying in and taking out Wafer W to the wafer cassette CR, The processing block 11 which comes to carry out multi-stage arrangement of the various processing stations of single wafer processing which performs one predetermined processing at a time to Wafer W in a SOD application process in a predetermined position, It has the composition which connected to one the cabinet 12 in which the bottle of the aqueous ammonia needed at an aging process, the bubbler, the drain bottle, etc. were installed.
[0015] In the cassette block 10, as shown in drawing 1 , the wafer cassette CR to four pieces turns each wafer entrance to the position of salient 20a on the cassette installation base 20 at the processing block 11 side, and are laid in the direction single tier of X in it, for example. [two or more] The wafer conveyance object 21 which can move in the wafer array direction (Z

perpendicular direction) of the wafer contained in the cassette array direction (the direction of X) and the wafer cassette CR accesses each wafer cassette CR alternatively. Furthermore, this wafer conveyance object 21 is constituted possible [rotation] in the direction of theta, and can also access now delivery / cooling plate (TCP) which belongs to the multi-stage station section of 3rd group G3 by the side of the processing block 11 so that it may mention later.

[0016] In the processing block 11, as shown in drawing 1 , the perpendicular conveyance type main wafer conveyance mechanism 22 as a transport device is formed in a core, all processing stations cover the surroundings of it at 1 set or two or more groups, and it is arranged multi-stage. In this example, 4 sets is G1, G2, G3, and the multi-stage arrangement composition of G4, and the multi-stage station of the 1st and 2nd groups G1 and G2 is juxtaposed at a system transverse-plane (it sets to drawing 1 and is this side) side, the multi-stage station of 3rd group G3 adjoins the cassette block 10, and is arranged, and the multi-stage station of the 4th group G4 adjoins a cabinet 12, and is arranged.

[0017] As shown in drawing 2 , in the 1st group G1, put Wafer W on a spin chuck within Cup CP, and insulator layer material is supplied. The SOD application processing station which applies a uniform insulator layer material on a wafer by rotating a wafer (staphylococcal clumping test), Put Wafer W on a spin chuck within Cup CP, for example, medical fluids for an exchange, such as HMDS and a heptane, are supplied. The solvent exchange processing station (DSE) which performs processing which transposes the solvent in the insulator layer applied on the wafer to other solvents in front of a dryness process has put on two steps in order of the lower shell.

[0018] In the 2nd group G2, the wafer W with which insulator layer material was applied at the SOD application processing station (staphylococcal clumping test) was made to foam under reduced pressure, and the reduced-pressure-drying station (DCD) to dry and the SOD application processing station (staphylococcal clumping test) have put on two steps in order of the lower shell.

[0019] As shown in drawing 3 , in 3rd group G3, two hypoxia heating-at-high-temperature processing stations (OHP), low-temperature heat-treatment stations (LHP), two cooling processing stations (CPL), delivery / cooling plates (TCP), and cooling processing stations (CPL) are arranged sequentially from the top multi-stage. here -- a hypoxia heating-at-high-temperature processing station (OHP) -- **** -- it has the hot platen by which Wafer W is laid in the processing interior of a room [-izing / the interior of a room], and it exhausts from the center of the processing room upper part, breathing out N2 from the hole of the periphery of a hot platen to homogeneity, and heating-at-high-temperature processing of the wafer W is carried out in hypoxia-ized atmosphere A low-temperature heat-treatment station (LHP) has the hot platen in which Wafer W is laid, and carries out low-temperature heat-treatment of the wafer W. A cooling processing station (CPL) has the cooling plate with which Wafer W is laid, and carries out cooling processing of the wafer W. Delivery / cooling plate (TCP) is made into the cooling plate which cools Wafer W in the lower berth, and the two-step structure of delivering to an upper case and having a base, and delivers Wafer W between the cassette block 10 and the processing block 11.

[0020] In the 4th group G4, a low-temperature heat-treatment station (LHP), two hypoxia cures and cooling processing stations (DCC), and aging processing stations (DAC) are arranged sequentially from the top multi-stage. here -- a hypoxia cure and a cooling processing station (DCC) -- **** -- it has so that the processing interior of a room [-izing / the interior of a room] may be adjoined in a hot platen and a cooling plate, and cooling processing of the wafer W heat-treated while carrying out heating-at-high-temperature processing in the hypoxia atmosphere replaced N2 is carried out an aging processing station (DAC) -- **** -- the processing gas (NH3+H2O) which mixed for example, ammonia gas and the steam is introduced into the processing interior of a room [-izing / the interior of a room], aging processing of the wafer W is carried out, and the wet gelling of the insulator layer material on Wafer W is carried out

[0021] The wafer transport device 30 which can go up and down freely in the vertical direction (Z direction) inside the tubed base material 27 which drawing 4 is the perspective diagram having shown the appearance of the main wafer conveyance mechanism 22, and consists of walls 25

and 26 of the couple which this main wafer conveyance mechanism 22 is mutually connected by the upper limit and the soffit, and counters is equipped. It connects with the axis of rotation of a motor 31, and the tubed base material 27 rotates to the wafer transport device 30 and one focusing on the aforementioned axis of rotation with the rotation driving force of this motor 31. Therefore, the wafer transport device 30 can be freely rotated in the direction of theta. On the conveyance pedestal 40 of this wafer transport device 30, it has three pincettes, for example. These pincettes 41, 42, and 43 all have the gestalt and size which can pass both the walls 25 of the tubed base material 27, and the side opening 44 between 26 freely, and they are constituted so that order movement may be attained along the direction of X. And the main wafer conveyance mechanism 22 accesses pincettes 41, 42, and 43 at the processing station arranged at the circumference, and delivers Wafer W between these processing stations.

[0022] Next, a SOD application processing station (staphylococcal clumping test) is explained. Drawing 5 and drawing 6 are the outline cross sections and outline plans showing the whole SOD application processing station (staphylococcal clumping test) composition.

[0023] The annular cup CP is arranged in the center section of this SOD application processing station (staphylococcal clumping test), and the spin chuck 52 is arranged inside Cup CP. Where fixed maintenance of the wafer W is carried out by vacuum adsorption, the rotation drive of the spin chuck 52 is carried out by the drive motor 54. The drive motor 54 is combined with the rise-and-fall driving means 60 and the rise-and-fall guide means 62 which consist of a pneumatic cylinder through the flange material 58 of the shape of a cap which is arranged possible [rise-and-fall movement to opening 50a prepared in the unit bottom plate 50], for example, consists of aluminum. The tubed cooling jacket 64 which consists of an SUS is attached in the side of a drive motor 54, and the flange material 58 is attached so that the Johan section of this cooling jacket 64 may be covered.

[0024] At the time of the application of insulator layer material, soffit 58a of the flange material 58 is stuck to the unit bottom plate 50 near the periphery of opening 50a, and the interior of a unit is sealed by this. When delivery of Wafer W is performed between a spin chuck 52 and the pincette 41 (42 43) of the main wafer conveyance mechanism 22, the soffit of the flange material 58 floats from the unit bottom plate 50 because the rise-and-fall driving means 60 raise a drive motor 54 or a spin chuck 52 upwards.

[0025] The nozzle 86 for supplying insulator layer material to the front face of Wafer W is connected to the insulator layer material feed zone 89 through the supply pipe 88. This nozzle 86 is attached in the point of the nozzle scan arm 92 removable through the nozzle supporter 100. This nozzle scan arm 92 is attached on the unit bottom plate 50 at the upper-limit section of the perpendicular supporter material 96 in which horizontal displacement is possible on the guide rail 94 laid by ** (the direction of Y) on the other hand, and moves in the direction of Y with the direction drive of Y which is not illustrated at the perpendicular supporter material 96 and one.

[0026] Furthermore, the nozzle scan arm 92 is movable also in the direction of Y, and the right-angled direction of X in order to attach a nozzle 86 alternatively in the nozzle standby section 90. and it moves also in the direction of X with the direction drive of X which is not illustrated.

[0027] The insulator layer material at the nose of cam of a nozzle solidifies or deteriorates by the delivery of a nozzle 86 being inserted in mouth 90a of a solvent atmosphere room in the nozzle standby section 90, and being exposed to the atmosphere of a solvent in inside further again. Moreover, two or more nozzles 86 are formed, for example, those nozzles are properly used according to the kind of insulator layer material. Moreover. the nozzle 86 is attached so that a delivery may be located on the straight line which meets in the Y move direction of the nozzle scan arm 92.

[0028] Next, a reduced-pressure-drying station (DCD) is explained. Drawing 7 is the cross section showing the composition of a reduced-pressure-drying station (DCD).

[0029] The chamber 201 as a processing room consists of combination of a pedestal 202 and a lid 203.

[0030] The hot platen 204 is arranged on the pedestal 202. A heater 205 is arranged in a hot platen 204, and, thereby, a hot platen 204 is set as desired temperature.

[0031] Plurality 206, for example, three rise-and-fall pins, can appear frequently from hot-platen

204 front face by the elevator style 207 arranged at the rear-face side of a hot platen 204. And after the rise-and-fall pin 206 has projected from hot-platen 204 front face, delivery of Wafer W is performed between the main wafer conveyance mechanisms 22.
[0032] The lid 203 is arranged by the elevator style 208 possible [rise and fall]. And when a lid 203 descends, a closed space S is formed between a pedestal 202 and a lid 203.
[0033] The exhaust port 209 is formed in the lid 203, and the inside of a closed space S is exhausted by the vacuum pump 210 through this exhaust port 209, and it changes into the state near a vacuum about 0.05Torr-1Torr.
[0034] In the rear face of a lid 203, the EB unit 211 which irradiates an EB to the wafer W arranged on a hot platen 204, and the scanner 212 which scans this EB unit since it continues all over wafer W and the EB irradiated from this EB unit 211 is irradiated are arranged. Even if a scanner 212 may move the EB unit 211 to ** on the other hand corresponding to the EB unit 211 and it moves it in the XY direction, it is not cared about. Moreover, the EB unit 211 irradiates an EB intensively and, thereby, makes the lower layer section 214 foam in the lower layer section 214 intensively among the lower layer sections 214 of the insulator layer material 213 and the managements 215 which were applied to Wafer W, as shown in drawing 8 .
[0035] Next, operation in the SOD system 1 constituted in this way is explained. Drawing 9 shows the processing flow in this SOD system 1.
[0036] In the cassette block 10, the wafer W before processing is conveyed to the delivery base in delivery / cooling plate (TCP) which belongs to 3rd group G3 by the side of the processing block 11 through the wafer conveyance object 21 from the wafer cassette CR first.
[0037] The wafer W conveyed on the delivery base in delivery / cooling plate (TCP) is conveyed through the main wafer conveyance mechanism 22 at a cooling processing station (CPL). And at a cooling processing station (CPL), Wafer W is cooled to the temperature which suits the processing in a SOD application processing station (staphylococcal clumping test) (Step 901).
[0038] The wafer W by which cooling processing was carried out is conveyed through the main wafer conveyance mechanism 22 at a SOD application processing station (staphylococcal clumping test) at a cooling processing station (CPL). And as for Wafer W, SOD application processing is performed at a SOD application processing station (staphylococcal clumping test) (Step 902).
[0039] The wafer W with which SOD application processing was performed at the SOD application processing station (staphylococcal clumping test) is conveyed through the main wafer conveyance mechanism 22 at a reduced-pressure-drying station (DCD), and reduced-pressure-drying processing is performed (Step 903).
[0040] At a reduced-pressure-drying station (DCD), the wafer W with which insulator layer material was first applied by the SOD application processing station (staphylococcal clumping test) is laid in a hot platen 204 through the main wafer conveyance mechanism 22. And while the inside of a closed space S is formed, this closed space is made into a vacua. In this state, an EB is irradiated to the wafer W laid in the hot platen 204 from the EB unit 211, and insulator layer material foams (step 903A). Continuously, the temperature up of the hot platen 204 is carried out to predetermined temperature, and dryness processing under reduced pressure is performed (step 903B). In addition, you may be made to perform Steps 903A and 903B almost simultaneous.

[0041] The wafer W with which dryness processing was performed is conveyed through the main wafer conveyance mechanism 22 at an aging processing station (DAC) at a reduced-pressure-drying station (DCD). At this time, to be shown in drawing 10 , the control section 216 is controlling conveyance of the main wafer conveyance mechanism 22 so that the time T taken to convey Wafer W from a reduced-pressure-drying station (DCD) to an aging processing station (DAC) becomes fixed. Thereby, dispersion in a dielectric constant or thickness can be suppressed.
[0042] And at an aging processing station (DAC), Wafer W introduces NH3+H2O into the processing interior of a room, carries out aging processing of the wafer W, and gels the insulator layer material film on Wafer W (Step 904).
[0043] The wafer W by which aging processing was carried out is conveyed through the main

wafer conveyance mechanism 22 at a solvent exchange processing station (DSE) at an aging processing station (DAC). And at a solvent exchange processing station (DSE), processing with which, as for Wafer W, the medical fluid for an exchange replaces the solvent in the insulator layer which was supplied and was applied on the wafer to other solvents is performed (Step 905).

[0044] The wafer W with which substitution processing was performed is conveyed through the main wafer conveyance mechanism 22 at a low-temperature heat-treatment station (LHP) at a solvent exchange processing station (DSE). And at a low-temperature heat-treatment station (LHP), low-temperature heat-treatment of the wafer W is carried out (Step 906). Of course, it does not matter even if it also performs this low-temperature heat-treatment under hypoxia atmosphere or reduced pressure.
[0045] The wafer W by which low-temperature heat-treatment was carried out is conveyed through the main wafer conveyance mechanism 22 at a hypoxia heating-at-high-temperature processing station (OHP) at a low-temperature heat-treatment station (LHP). And at a hypoxia heating-at-high-temperature processing station (OHP), as for Wafer W, heating-at-high-temperature processing in hypoxia-ized atmosphere is performed (Step 907).
[0046] The wafer W with which heating-at-high-temperature processing was performed is conveyed through the main wafer conveyance mechanism 22 at a hypoxia cure and a cooling processing station (DCC) at a hypoxia heating-at-high-temperature processing station (OHP). And at a hypoxia cure and a cooling processing station (DCC), in hypoxia atmosphere, heating-at-high-temperature processing is carried out, and cooling processing of the wafer W is carried out (Step 908).
[0047] The wafer W processed at the hypoxia cure and the cooling processing station (DCC) is conveyed through the main wafer conveyance mechanism 22 to the cooling plate in delivery / cooling plate (TCP). And cooling processing of the wafer W is carried out in the cooling plate in delivery / cooling plate (TCP) (Step 909).
[0048] The wafer W by which cooling processing was carried out with the cooling plate in delivery / cooling plate (TCP) is conveyed through the wafer conveyance object 21 to the wafer cassette CR in the cassette block 10.
[0049] In this operation gestalt, since foaming processing is performed at the reduced-pressure-drying station (DCD), as shown in drawing 15 , a bubble 111 can remain in 110 in an insulator layer, and specific inductive capacity can be reduced by existence of this bubble 111. Moreover, since this foaming and dryness are performed under reduced pressure, the bubble 111 generated in an insulator layer 110 is not crushed. Therefore, capacity during the wiring 112 formed in this layer can be made small. Moreover, since foaming processing is performed so that the lower layer section may foam intensively among 110 in an insulator layer especially, there is no bubble in a front face, for example, application of the DAMASHIN method becomes easy.
[0050] With the above-mentioned operation gestalt, although foaming processing in a reduced-pressure-drying station (DCD) was performed using the EB, as shown in drawing 11 , even if it attaches a sonicator 301 in a hot platen 204 and supplies an ultrasonic wave to the insulator layer material on Wafer W through a hot platen 204, foaming processing can be performed. Moreover, foaming processing can be performed, even if it attaches a vibration generator system 302 in a hot platen 204 and gives vibration to the insulator layer material on Wafer W through a hot platen 204, as shown in drawing 12 . Furthermore, as shown in drawing 13 , foaming processing can be performed also by attaching the infrared lamp 303 which irradiates infrared radiation to Wafer W on a hot platen 204, and irradiating infrared radiation at the insulator layer material on the wafer W on a hot platen 204. In this case, an infrared lamp 303 can be used together as a means to calcinate the front face of insulator layer material at the time of dryness, and can stiffen a front face by this, for example, it becomes easy to apply [of the DAMASHIN method] it.
[0051] Moreover, this invention is not limited to the operation gestalt mentioned above, but various deformation is possible for it.
[0052] For example, the dielectric constant makes the low gas beforehand dissolved in insulator layer material rather than insulator layer material, and you may make it actualize a gas as a

bubble under the reduced pressure at the time of the above-mentioned dryness. Thereby, in addition to the bubble of the above-mentioned vacuum, the specific inductive capacity of an insulator layer can be reduced also with this bubble.
[0053] Furthermore, in case dryness processing of the wafer W is carried out at a reduced-pressure-drying station (DCD), it dries to the grade which can maintain the fluidity of insulator layer material to some extent (step 903C), Wafer W is turned over after that, and you may make it dry, as shown in drawing 14 (step 903D). When Wafer W is turned over, a bubble will float up and a bubble will focus into the insulator layer during wiring. By this, the specific inductive capacity of an insulator layer can be reduced, moreover, there is no bubble, and a front face can be stiffened, for example, application of the DAMASHIN method becomes easy.
[0054] this invention is not limited to the gestalt of operation mentioned above, but can deform variously. For example, the substrates to process may be other things, such as not only a semiconductor wafer but a LCD substrate. Moreover, a membranous kind is not restricted to a layer insulation film.

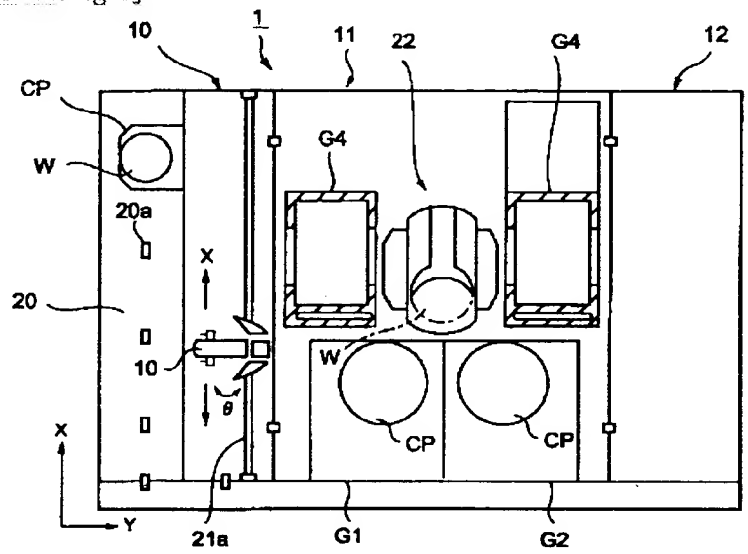
[Translation done.]

DESCRIPTION OF DRAWINGS

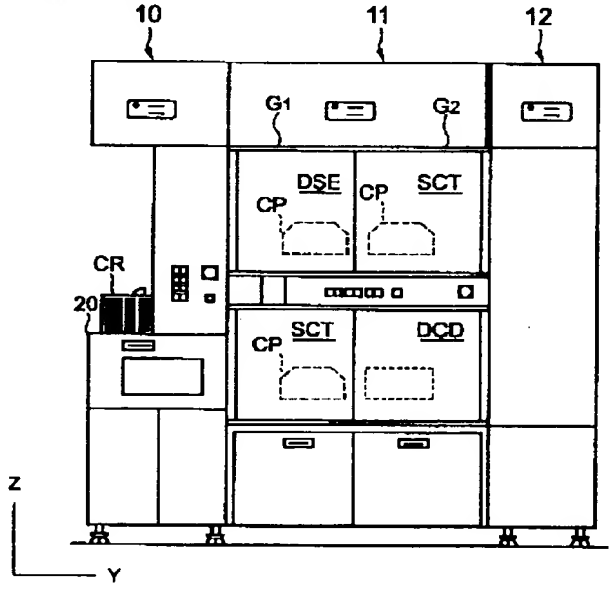
[Brief Description of the Drawings]
[Drawing 1] It is the plan of the SOD processing system concerning the gestalt of operation of this invention.
[Drawing 2] It is the front view of the SOD system processing shown in drawing 1 .
[Drawing 3] It is the rear view of the SOD processing system shown in drawing 1 .
[Drawing 4] It is the perspective diagram of the main wafer conveyance mechanism in the SOD processing system shown in drawing 1 .
[Drawing 5] It is the front view of the SOD application processing station shown in drawing 2 .
[Drawing 6] It is the plan of the SOD application processing station shown in drawing 5 .
[Drawing 7] It is the front view of the reduced-pressure-drying station shown in drawing 2 .
[Drawing 8] It is drawing for explaining an operation of EB unit shown in drawing 7 .
[Drawing 9] It is the processing flow view of the SOD processing system shown in drawing 1 .
[Drawing 10] It is a rough perspective diagram for explaining the transfer control in this invention.
[Drawing 11] It is the front view of the reduced-pressure-drying station concerning other operation gestalten of this invention.
[Drawing 12] It is the front view of the reduced-pressure-drying station concerning still more nearly another operation gestalt of this invention.
[Drawing 13] It is the front view of the reduced-pressure-drying station concerning operation gestalt of this invention another again.
[Drawing 14] They are other processing flow views of the SOD processing system concerning this invention.
[Drawing 15]

DRAWINGS

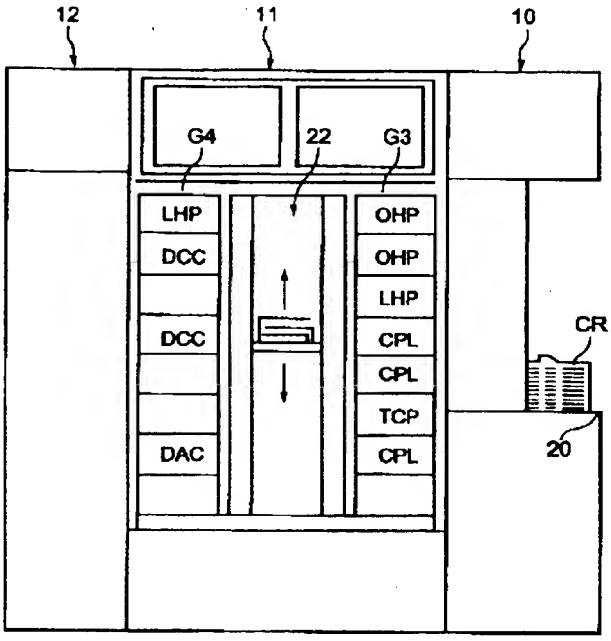
[Drawing 1]



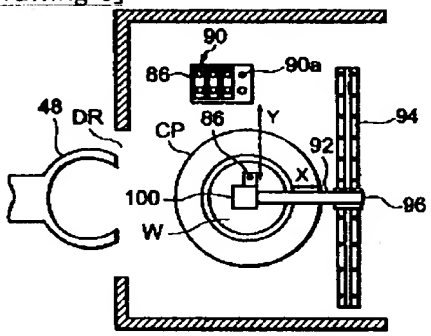
[Drawing 2]



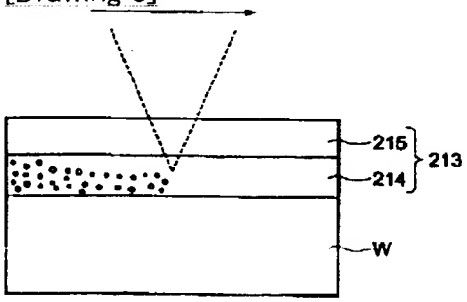
[Drawing 3]



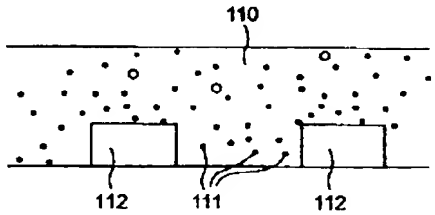
[Drawing 6]



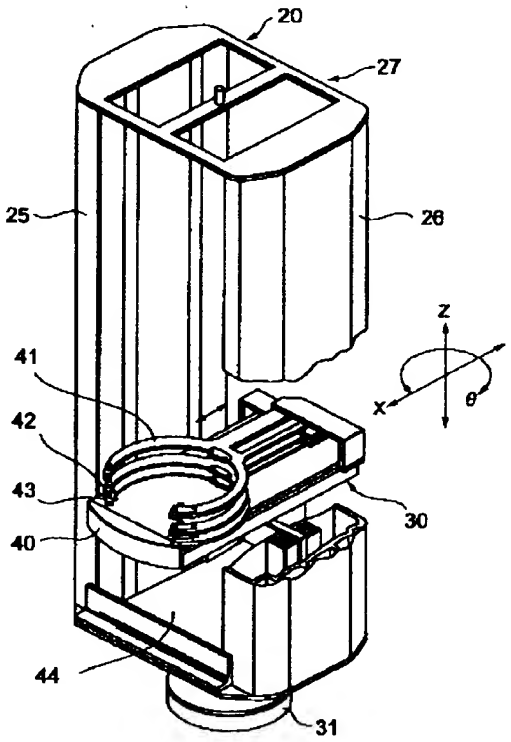
[Drawing 8]



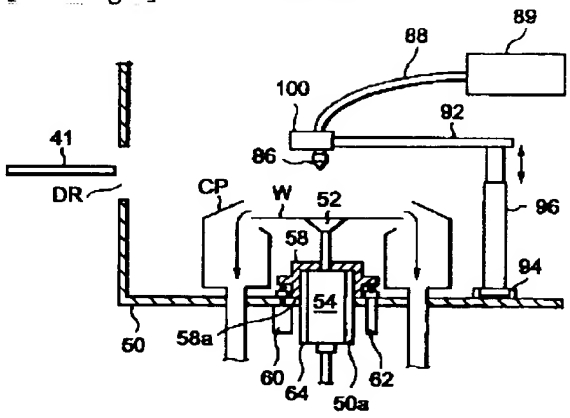
[Drawing 15]



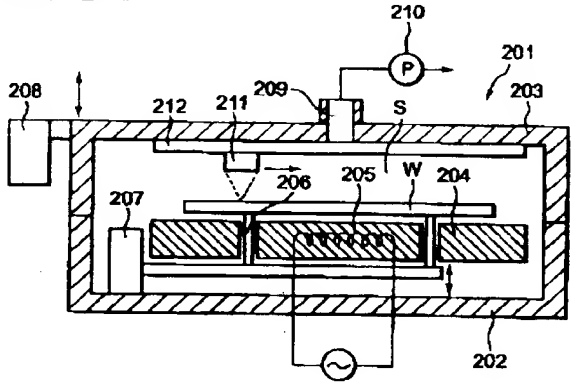
[Drawing 4]



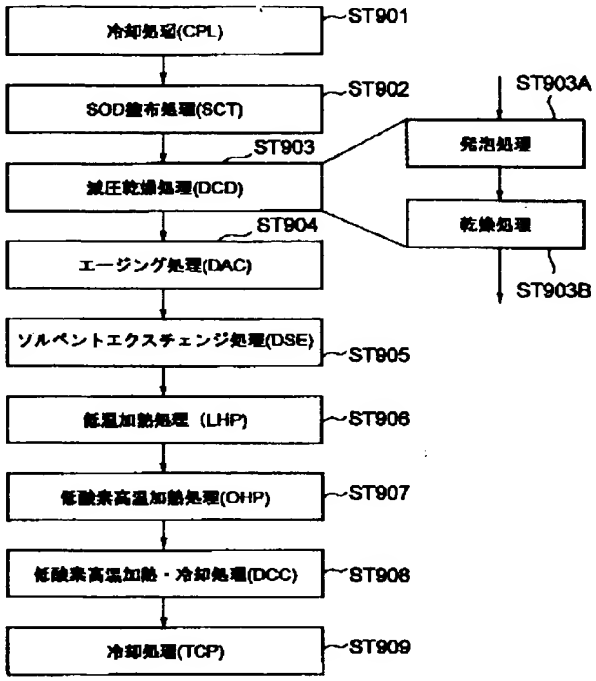
[Drawing 5]



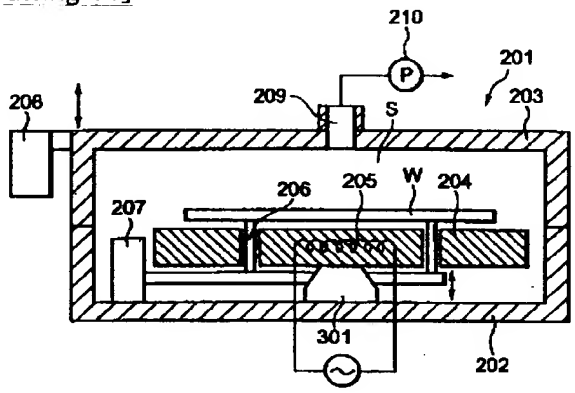
[Drawing 7]



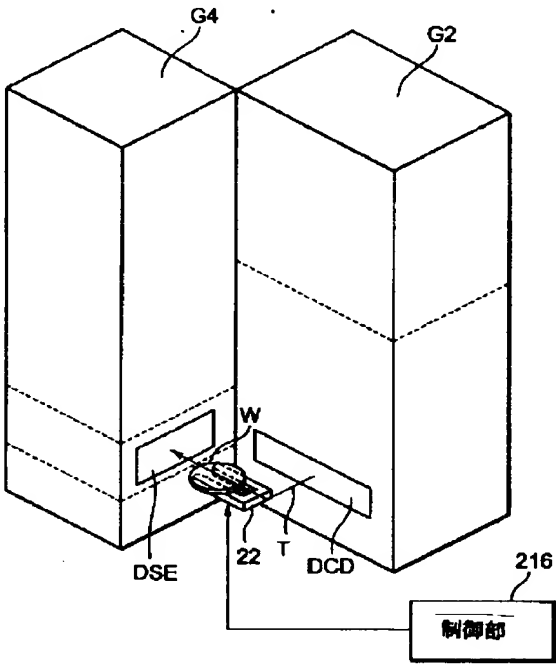
[Drawing 9]



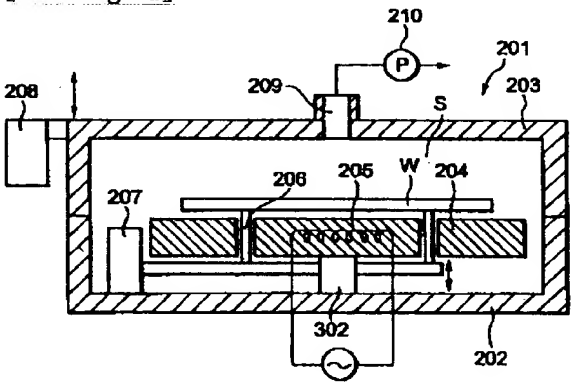
[Drawing 11]



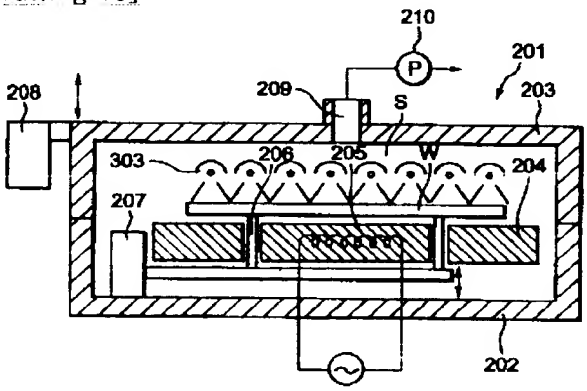
[Drawing 10]



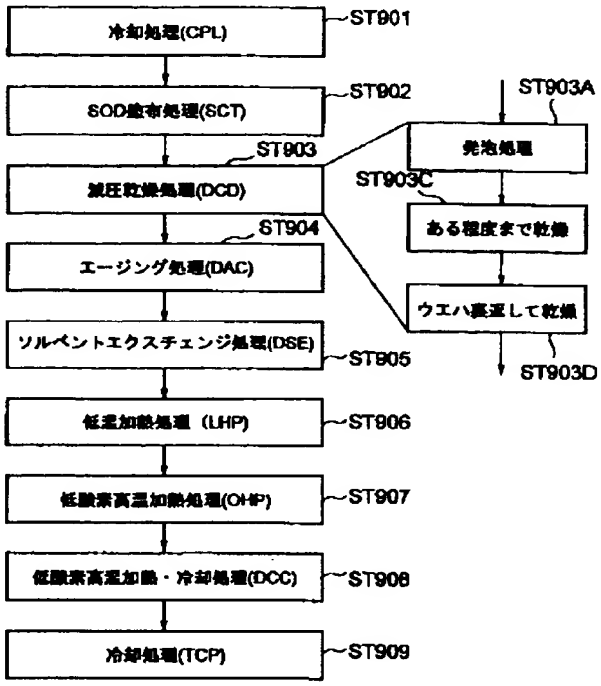
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]